Resource Action: EWG-66 **Task Force Recommendation Category:** 2

RIPARIAN HABITAT ENHANCEMENT IN THE HIGH FLOW CHANNEL OF THE FEATHER RIVER

Description of Potential Resource Action:

This Resource Action proposes to enhance or create riparian vegetation along the high flow channel of the Feather River. This would be accomplished by 1) developing a hydrologic flow regime that would support natural regeneration of riparian vegetation and/or 2) actively planting riparian trees and shrubs along shorelines, side channels, and other appropriate areas within the Feather River floodplain.

The following Resource Actions are either similar to or directly related to the proposed measure:

- EWG 51 – enhance riparian vegetation along the low flow channel of the Feather River
- EWG 61 – proposes to increase riparian recruitment in the OWA through development of a hydrological flow regime
- EWG 67 – proposes to plant/restore wetland and riparian vegetation around the margins of the Thermalito Complex
- EWG 68B – proposes to enhance riparian vegetation within the upper portion of the drawdown zone of Lake Oroville

Fisheries improvement related:

- EWG 22 – improve connectivity of floodplain to Feather River in lower Feather River
- EWG 99 – enhance side channels for salmonid spawning in Feather River between Oroville Dam and Honcut Creek
- EWG 104 – increase connectivity of Lower Feather River to floodplain habitats

Nexus to Project:

Channel movement, geology, and hydrology are physical factors largely responsible for the development and maintenance of riparian forests along the Feather River. Many factors, including construction of the dam at Lake Oroville, historic land use activities (hydraulic mining), levees, and regulation of stream flows have impacted these riparian ecosystems downstream of Oroville Dam.

Potential Environmental Benefits:

Riparian systems provide a number of important functions to both the aquatic and terrestrial ecosystems associated with them, including steam bank stabilization, temperature moderation by shading, stream structural diversity, and wildlife habitat. The diversity and density of wildlife species associated with these ecosystems is disproportionately high in comparison to other plant communities. A more structurally and species diverse riparian system along the Feather River would enhance both fish and wildlife habitats as well as aesthetic qualities and help decrease invasions by noxious and invasive plant species.

Potential Constraints:

Riparian vegetation along the Feather River has been affected by a myriad of causes stemming from the disruption of natural geomorphic processes including historic hydraulic mining, historic and current land uses, flood control levees, flow regulation, and the presence of dams including Oroville Dam. The dams block sediment recruitment from the upstream basin; levees along the Feather River have reduced the accessibility of the Feather River to its floodplain; and conversion of the floodplain to agriculture has reduced the area available for riparian establishment.

A number of potential constraints are associated with the enhancement of riparian vegetation along the Feather River:

- To increase riparian recruitment through modification of the hydrologic regime involves increased stream flows at the expense of hydropower generation and water supply
- Increasing the frequency and/or magnitude of flows will also affect downstream properties
- Levees constrain river from accessing floodplain
- Any work within the bed, bank, and floodplain will involve permitting from a number of agencies (CDFG, ACOE, SWQCB, etc.)

Existing Conditions in the Proposed Resource Action Implementation Area:

The Feather River has a long history of land uses which have affected natural river processes within its floodplain. Currently, the Feather River riparian forests downstream of Oroville Dam are fragmented and narrow compared to historic riparian forests. Approximately 4,268 acres of riparian forests; 2,175 acres of riparian shrub; and 210 acres of wetlands were mapped within the FEMA 100-year floodplain of the Feather River below the Project Area (DWR 2004). In many areas constrained by levees, urbanization, or agriculture; riparian vegetation is only a thin band of trees one tree canopy wide with little to no understory (Figure 1). In other

areas, especially in areas of large meander bends, large patches of riparian habitats exist (Figure 2).

Figure 1. Feather River riparian vegetation.

Figure 2. Riparian vegetation along Feather River at ~RM 34.

Cottonwood recruitment studies indicate that although some limited recruitment has occurred, recent recruitment has been scarce in the low flow and high flow reaches of the Feather River. The paucity of successful recruitment suggests that current project operations tend to prevent initial seedling survival, longer-term establishment of seedlings, or both. The failure of cottonwood recruitment in the riparian zone of the high flow reach may be attributable to failure during initial seedling survival, and the frequent occurrence of scouring discharges. Opportunities for seedling germination along point bars (Figure 3) were evident for many of the years between 1992 and 2001 where relatively steady river stages occurred during the window of seed dispersal. However, the rapid ramping down of flow after storm events and high summer flows may limit seedling survival. Germinating seedlings observed during field studies in 2002 were later covered by high summer flows and did not survive through that season.

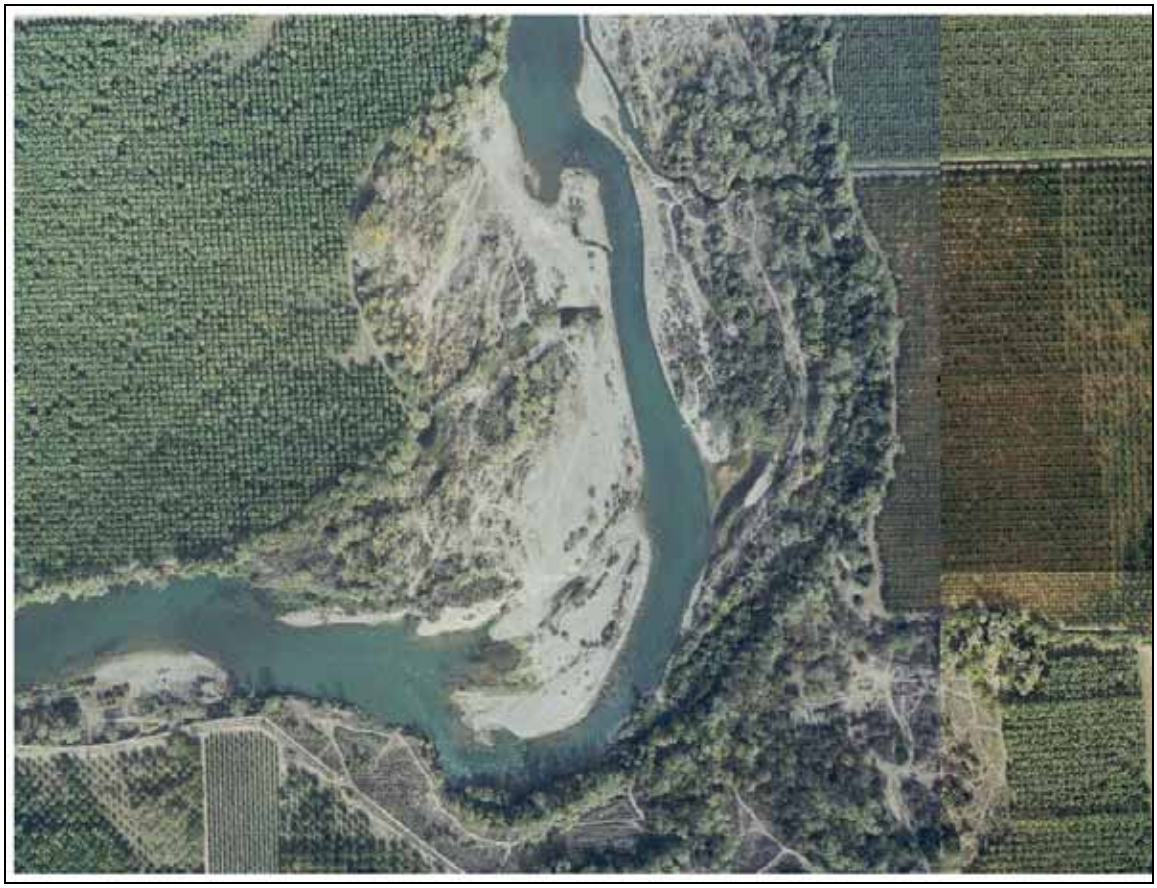

Figure 3. Site of germinating seedlings that did not survive high summer flows.

Design Considerations and Evaluation:

This Resource Action addresses riparian enhancement either by hydrologic regime modification, planting of riparian species, or both. Under natural conditions, riparian pioneer species, such as cottonwoods and willows, colonize bare (scoured), moist alluvial surfaces, typically present after high flow events. During high flow events, overflow of the bankfull stage connects the floodplains with the main channel. As the flood waters recede; the barren, moist soils are germination sites for early successsional species such as cottonwoods. These species generally release their seeds in late spring (April – June) when historic high flows would most likely be receding. As the seeds germinate on these moist surfaces, the rate of water-level decline must not exceed the seedling root growth rate or the seedlings will desiccate and die.

During field studies along the Merced, Sacramento, and Feather Rivers, it has been observed that floodplain depressions, high flow channels, and other off-channel sites that historically received overbank flooding and sediment deposition were more likely to provide conditions conducive to successful establishment under regulated flow regimes.

Riparian enhancement by modification of the hydrologic regime during the April through June period would best be considered in combination with a number of other Resource Actions involving geomorphic modifications, levee setbacks, side channel enhancements, noxious weed management, and active riparian species plantings. Opportunities for flow enhancement in the high-flow reaches appear limited by the difference between the flows occurring at the time of seed germination and initial establishment, generally between 1,500 and 3,000 cfs, and the higher mid-to-late summer flows that occur in many years. The summer flows likely drown or scour the small-growth seedlings nearer the water's edge. Seedlings that may germinate in back channels and swales, probably dry out and die as the water is ramped down at a rate exceeding that of the seedling root growth. In some years, however, relatively high flows in the range (at the Gridley gage) of 6,000 – 7,000 cfs occur earlier in the summer, commencing in late June (for example, 1997 and 2000). The timing of these higher flows approach the tail end of cottonwood seed dispersal and might support seed germination. Flow enhancement would consist of initiating discharges of 6,000 to 7,000 cfs a week or two earlier in June, particularly in years when cottonwood seed dissemination is delayed by weather conditions, and extending the flows in this range a week or two longer into the late summer. Flows would need to be ramped down gradually, so that river stage at desired sites declined by about one foot a day, allowing seedling roots to extend deeper into the ground as the water table dropped. The efficacy of this approach would need to be tested by monitoring seedling occurrence and survival at selected sites. Opportunity to implement a flow augmentation of this duration and magnitude would probably occur infrequently, perhaps every five or ten years.

Large blocks of riparian vegetation are most desirable for both wildlife habitat and riparian species diversity. A few areas identified along the Feather River may benefit from flow enhancement when coupled with an appropriate ramping down rate. Vegetation in side channels and swales may be scoured during high flows. With an appropriate ramp-down rate, germinating seedlings may be able to survive. These same channels may also benefit from active planting of riparian species. A number of actions could be combined to increase the size of existing riparian vegetation in some areas. For example, the vegetation on the right bank at RM 55 (in Project area) and on the left bank at ~RM 54.5 (out of Project area) may be expanded using a combination of increased flows, appropriate ramping down rates, and active plantings of riparian species, both within the channel, low-lying areas with the gravel bars, and within excavated areas in the adjacent dredge tailings of the Oroville Wildlife Area.

Synergism and Conflicts:

The goal of this Resource Action is to increase riparian vegetation and to provide a functional riparian corridor along the Feather River. This is compatible and should be considered in combination with a number of other Resource Actions involving geomorphic modifications, levee setbacks, side channel enhancements, floodplain connectivity, noxious weed management, etc.

Conflicts exist between the demands for water for hydropower generation and water supply and the timing of releases for riparian species recruitment coupled with a ramping down rate equal to the growth of seedling/sapling root growth.

Uncertainties:

A number of uncertainties concerning existing constraints on cottonwood recruitment in the Feather River preclude recommending feasible flow enhancement measures at this time. A ramping down of late spring flows for seedling establishment may increase initial recruitment. However, the relatively high summer flows would likely drown or scour out the young seedlings near the water's edge. The efficacy of this approach would need to be tested by monitoring seedling occurrence and survival at selected sites. Opportunity to implement a flow augmentation of this duration and magnitude would probably occur once every five to ten years. Opportunities do exist to restore riparian habitats by other methods in swales and old channels within the floodplain of the Feather River downstream of the Project area.

If a modified hydrologic regime were to be used to increase riparian vegetation, this Resource Action could be a component of an overall strategy for improving conditions and restoring a functional riparian and floodplain corridor along this reach

of the Feather River. This would require a complex engineering and environmental design analysis.

Cost Estimate:

Costs for this Resource Actions would vary greatly depending upon the action and/or combination of actions. Planting of riparian species and site preparation alone are estimated at $3,000 to $8,000 per acre. Acquisition of agricultural lands can run from approximately $4000 to $8000 per acre.

The cost of flow modifications has not been quantified. Such flows should mimic natural high flow events with an appropriate ramp down rate. Under current operations, the ramp down rate after high flow events is moderately fast to maximize the water storage in Lake Oroville. Providing such flows for riparian recruitment would probably be at the expense of power generation and water supply to downstream users.

Recommendations:

Riparian enhancement measures should be considered for the Feather River. At present, riparian habitats are fragmented; have low structural and species diversity; and are not being replaced. This measure should be considered in combination with other Resource Actions that aim to improve the functional riparian system.

A number of small-scale actions could be combined to enhance a variety of environmental resources. Side channel improvements, levee setbacks, floodplain connectivity, weed management, etc. with a riparian planting component would enhance riparian habitats along the Feather River.

Literature Cited:

CDWR (California Department of Water Resources) 2004. SP-T3/5 Project Effects on Riparian Resources, Wetlands, and Associated Floodplains. Draft Final Report. July 2004.